Section 4
Summary of the Selected Remedy

On the basis of the evaluations presented as part of the Remedial Investigation (RI) (G&M, 1996a) and the Feasibility Study (FS) (G&M, 1997), the U.S. EPA selected the remedy for OU-4, which is described in the Record of Decision (ROD) that was issued on September 28, 2001. The remedy was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), as well as the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300). The remedy is consistent with the criteria contained in Section 121 of CERCLA, as summarized in Section I(J) (Statutory Determinations) of the ROD, including protection of human health and the environment, compliance with Applicable or Relevant and Appropriate Requirements (ARARs), and cost-effectiveness. The State of Michigan concurred with the selected remedy.

4.1 Remedial Action Objectives

The overall objectives of the selected remedy, as stated in the ROD, are as follows:

- To eliminate the continued migration of PCBs from the 12th Street Landfill (OU-4) to the Kalamazoo River, as well as from the landfill to the woodland, wetland, adjacent (asphalt plant) property, and the former powerhouse discharge channel.
- To reduce the unacceptable risk associated with the landfill from exposure to PCBs, including the following:
  - Human health risks for persons who trespass or work on the 12th Street Landfill
  - Human health and ecological risks owing to past and continuing releases of PCBs to the woodland, wetlands, adjacent property, former powerhouse discharge channel, and the Kalamazoo River
  - Human health and ecological risks owing to the potential additional release of PCBs to the woodland, wetlands, adjacent property, former powerhouse discharge channel, and the Kalamazoo River caused by failure of the sides of the landfill

4.2 Components of the Selected Remedy

The major components of the selected remedy, as stated in the ROD (U.S. EPA, 2001), include the following:

"1. Excavation and relocation into the landfill of contaminated residuals currently in the woodland, wetlands, and adjacent property, and the residuals in the former powerhouse discharge channel that are contiguous with the eastern side of the landfill. Following relocation into the landfill of the residual material, a containment system shall be constructed that complies with the requirements of

Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).

2. Excavation and relocation into the landfill of the east side of the landfill along the former powerhouse discharge channel. The excavation shall be extensive enough to create a buffer zone sufficient to ensure that, for the lifetime of the remedy, no hydraulic connection exists between the PCB-contaminated wastes within the newly constructed landfill containment system and the Kalamazoo River or the former powerhouse discharge channel.

3. Restoration of areas that are excavated, cleared and grubbed, or otherwise affected by the RA.

4. A sidewall containment system (SWCS) shall be constructed around the outside of the landfill. The existing sides of the landfill are constructed of sand, fly ash, and PCB-contaminated residuals and were not designed to provide sideslope stability, flood protection, and erosion control, or to prevent releases of leachate. The existing sides shall be completely covered by a new SWCS that is designed to prevent the release of PCBs and which provides the necessary sideslope stability, flood protection, and erosion control. The containment system shall be designed to meet the relevant portions of the Michigan Solid Waste Landfill closure regulations pursuant to Part 115, Solid Waste Management, of the NREPA. Disposal of the residuals with PCB contamination at or above 50 parts per million, which are PCB remediation wastes under the Toxic Substances Control Act (TSCA), will take place pursuant to the risk-based disposal method set forth in 40 CFR Section 761.61(c). The erosion protection provided shall be sufficient to protect the containment system from a 500-year flood event. The erosion protection shall extend to a minimum elevation of 707.0 feet above mean sea level, which is 2 feet above the 100-year flood elevation.

5. A cover (cap) will be constructed over the landfill as part of the containment system to minimize infiltration of precipitation through the landfill, prevent migration of residuals or leachate from the landfill into the adjacent areas, and eliminate direct contact hazards. The cap shall be designed to meet relevant portions of the closure regulations pursuant to Part 115, Solid Waste Management, of the NREPA. The cap consists of the following components from bottom to top:

   - A select granular fill layer at least six inches thick shall be placed on top of the landfill as a suitable subgrade for the cap. The need for a gas venting system shall be assessed by the PRPs in the remedial design (RD). If it is determined that a gas venting system is necessary, then this layer shall be designed and constructed to serve as a gas-venting layer. This gas-venting layer shall be capable of collecting the landfill gas produced and efficiently conveying it to a passive venting system. Clean granular fill from an off-site source, having a minimum hydraulic conductivity of 1 x 10^{-3} centimeters per second, shall be used to construct the layer.
   - A geomembrane liner (barrier layer) of at least 30-mil–thick polyvinyl chloride (PVC) or its equivalent, as approved by the lead agency, shall be placed over the granular fill. The PVC geomembrane liner shall act as a barrier to minimize infiltration of precipitation into the residuals. The most appropriate liner material shall be determined in the RD and must be approved by the lead agency.
   - A general fill layer (protective layer) at least 24 inches thick shall be placed above the 30-mil PVC geomembrane liner, or its equivalent. The protective layer shall be capable of sustaining the growth of nonwoody plants and shall have adequate water-holding capacity. The water that accumulates within this layer shall drain to a ditch or a sedimentation outlet structure and subsequently discharge into the Kalamazoo River.

- A vegetative layer at least six inches thick shall be placed over the protective layer. This layer shall be designed to promote vegetative growth, provide surface water runoff, and minimize erosion.

6. Following the completion of the RA, an appropriate groundwater monitoring network shall be installed, and long-term groundwater monitoring shall be performed in accordance with an approved monitoring plan. Existing wells that are no longer in use shall be properly abandoned. Monitoring of the groundwater aquifer under the landfill shall be conducted in accordance with Part 201, Environmental Remediation, of the NREPA, and the TSCA (40 CFR Section 761.75[b][6]).
7. Short-term surface water monitoring shall be conducted during excavation activities in accordance with a lead agency-approved monitoring plan.
8. Deed restriction, approved by the lead agency, that are necessary to appropriately restrict future land use pursuant to Section 20120(1)(i) of the NREPA shall be imposed on the landfill portion of the 12th Street OU4 before the RA is final.
9. A fence shall be constructed to enclose the landfill and permanent markers and approved warning signs shall be placed around the perimeter of the landfill as required by Part 201, Environmental Remediation, of the NREPA.
10. The need for a leachate collection system shall be investigated by the PRPs in the RD and shall be designed and constructed as part of the RA if determined to be necessary by the lead agency.
11. Provisions for long-term maintenance and post-closure care, approved by the lead agency, shall be implemented."

Note: Due to the implementation of Emergency Actions, as discussed in Section 4.3 below, the final selected remedy is presented in Section 6.0.

4.3 Completed Emergency Actions

Since the lodging of the CD for the 12th Street Landfill and the Plainwell Mill, but prior to the implementation of the RD/RA activities for the landfill, the U.S. EPA authorized Weyerhaeuser to implement certain Emergency Actions at the 12th Street Landfill operable unit to mitigate a potential release of paper residuals/sediment containing PCBs to the environment (the river) (U.S. EPA, 2007a). These Emergency Actions, which were completed in the summer and fall of 2007, were necessitated by the U.S. EPA's authorization earlier in 2007 of a TCRA in the former Plainwell Impoundment to be implemented by the KRSG in 2007 and 2008 (U.S. EPA, 2007b). The TCRA included, among other activities, the removal of the earthen section of the Plainwell Dam, which is located immediately upstream of the 12th Street Landfill. When the earthen dam, the temporary sheet pile containment system, and the upper logs in the temporary water control structure (installed as part of the TCRA) were removed in the spring of 2008, the former powerhouse channel became part of the new main channel of the Kalamazoo River. This flow condition significantly increased the velocity of the river in the former powerhouse channel, which was formerly a backwater, and along the eastern sideslope of the 12th Street Landfill.

As described in the Design Report for the Emergency Action (RMT, 2007a), the objectives of the Emergency Action were as follows:

- To remove visible paper residuals from the channel before the main flow of the Kalamazoo River was rerouted through the channel
- To install a final erosion protection system along the western bank of the former powerhouse channel in conformance with the requirements of the ROD.
- To conduct the Emergency Action in a manner that will be compatible with the other requirements specified in the ROD.

The Emergency Action was conducted pursuant to the Emergency Response Plan Design report (RMT, 2007a), the Multi-Area QAPP, and the Multi-Area FSP (RMT, 2007b, and 2007c, respectively).

The Emergency Action included the following activities:

- **Site preparation** – Site preparation involved clearing and grubbing along the riverbank and in limited areas of the landfill as required to allow for construction of the access road, a working area along the former powerhouse channel, and a containment area for placement of the excavated residuals and soil.
- **Grading of the eastern slope of landfill** – The eastern slope of the landfill was cut back to an approximately 5H:1V slope. All of the material removed from the eastern slope was moved onto the top of the landfill. Any visible paper residuals were placed within the mixed fill/paper residual containment area on the top of the landfill.
- **Channel dewatering and residuals removal** – A Portadam™ system was installed in the former powerhouse channel to allow for dewatering of the channel and to facilitate removal of the residuals. The water in the Portadam™ enclosure was removed to within 1.5 feet of the sediment surface and pumped through a basin and retention area prior to discharge to the Kalamazoo River. While the water levels were depressed, paper residuals were removed using a long-reach excavator in the former powerhouse channel. Any area with visible residual material was excavated, and the material was transported to the mixed fill/paper residual containment area on the top of the landfill. Sediment samples were collected to document the removal. Concentrations of PCBs in the remaining surface sediment were less than or equal to 1.0 mg/kg total PCBs. Approximately 600 cubic yards of material were removed from the channel and placed on the top of the landfill.

  In addition, the sediment/soil adjacent to the river was excavated to allow for the placement of the erosion protection system on the landfill and to limit the potential for the river to come in contact with paper residuals in the landfill. Soil excavated from the bank that contained visible residuals was also moved to the mixed fill/paper residual containment area. Soil excavated from the bank that did not contain visible residuals was moved to the top of the landfill and used to cover/grade the mixed fill/paper residual containment area. This area will also be capped by the final cover system for the 12th Street Landfill.
- **Residuals dewatering and disposal** – Excavated materials on the mixed fill/paper residual containment area on top of the landfill were dewatered by gravity drainage with infiltration through the bottom of the containment area.
- **Hydraulic separation** – A buffer zone was created along the former powerhouse channel by cutting back approximately 35 feet of the eastern slope of the landfill adjacent to the river (Figure 4-3). This

distance was created to provide space for the future construction of the landfill final cover and an approximately 10-foot–wide road for the future installation of, and access to, groundwater monitoring wells. A 2.5-foot–thick compacted clay barrier layer (between elevation 700.0 feet M.S.L. and 702.5 feet M.S.L.) with a hydraulic conductivity of 5.6 x 10^{-8} cm/s (RMT, 2008b) was installed along the base of the regraded eastern slope. This layer was installed to provide the required hydraulic separation between the paper residuals and the river along the eastern slope. The remainder of the landfill final cover will be constructed as part of the Remedial Action.

- **Erosion protection along the riverbank** – Following the removal of the visible paper residuals/sediment in the channel, the riverbank was regraded to a 3:1 slope. An 8-ounce nonwoven geotextile fabric was placed over the bank materials. This was overlain by riprap (D_{50} of 9 inches). A trench was keyed into the toe of the riverbank to prevent undercutting of the bank. A temporary silt fence was installed along the upslope edge of the riprap to contain potential sediment runoff from the face of the landfill.

  Upslope of the riprap, 6 inches of general fill material were placed on the eastern slope. This was overlain by 6 inches of topsoil. The topsoil was then covered by erosion control matting (Enkamat®, which is a three-dimensional nylon turf reinforcement mat made of nylon filaments joined at the intersections). The Enkamat® was hydroseeded to promote faster vegetative growth on the matting (Figure 4-3).

- **Vegetation** – The earthwork activities along the eastern slope of the landfill and the riverbank were completed in early October 2007, near the end of the growing season. The area above the hydroseeded Enkamat® was reseeded in the spring of July 2008.

Details of the activities completed as part of the Emergency Action are provided in a construction documentation report that was submitted to the U.S. EPA in July 2008 (RMT, 2008b).

As a result of the Emergency Action completed in 2007, the following components of the selected remedy for OU-4, described in Section 4.2, have either been fully or partially completed:

- **Excavation and relocation of residuals into the landfill** – Approximately 600 cubic yards of visible paper residuals in the former powerhouse channel were delineated, excavated, and relocated into the landfill. The results of the sediment samples that were collected and analyzed, indicated that the remaining concentrations of PCBs in the surface sediment were less than or equal to 1.0 mg/kg total PCBs.

  No further action is needed in the former powerhouse channel.

  Excavation along the eastern side of the landfill (along the former powerhouse channel) was extensive enough to create a buffer zone that is adequate to ensure that there will be no direct contact between the landfill containment system and the Kalamazoo River/former powerhouse channel.

  Excavation and relocation of residuals in woodland, wetlands, and the adjacent asphalt plant property will be completed as part of the Remedial Action.

- **Erosion protection and sidewall containment system on the eastern slope of the landfill** – Erosion protection and containment measures were installed on the eastern sideslope during the Emergency Action. Two of these measures are permanent, while two others are interim until the final cover system is constructed.

The two permanent measures that were installed are the riprap and the clay barrier layer. As described in the Emergency Response Plan Design report (RMT, 2007a), the riprap and the clay barrier layer are permanent measures that will not be removed during the Remedial Action. Installation of these measures as part of the Emergency Action allows for the rest of the final cover system, and associated erosion protection, to be installed above the elevation of the 2-year flood event (approximately 702.5 feet M.S.L.). The riprap was designed to provide protection from the 500-year flow velocity (5.7 feet per second). The riprap was installed over a geotextile fabric from the bottom of the river up to approximately 703.5 feet M.S.L. (the elevation of the access road along the riverfront is 703 feet M.S.L.). The clay barrier layer extends along the entire eastern sideslope, from elevation 700.0 feet M.S.L. to 702.5 feet M.S.L. The clay barrier layer will become part of the final cover system and provides sidewall containment and hydraulic separation from the Kalamazoo River.

In contrast, the 1-foot–thick earthen cover and the turf reinforcement mat (Enkamat®) are interim measures. The Enkamat® and the 1-foot–thick earthen cover were installed from 703 feet M S.L. to 707 feet M.S.L. These will be removed as part of the Remedial Action to facilitate regrading of the slope and placement of the final cover system prescribed in the ROD.

These components of the 12th Street Landfill Remedial Action adjacent to the fill area were completed during the Emergency Action. Extensions of the clay barrier layer and the riprap along the Kalamazoo River will be integrated into the final design because the proposed limits of the final cover will extend further north than the original landfill footprint.